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YALE UNIVERSITY

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Courses of Graduate Instruction

IN THE DEPARTMENT OF

PHILOSOPHY AND THE ARTS

1892-93



NEW HAVEN :

1892



# FACULTY OF GRADUATE INSTRUCTION

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HANNS OERTEL, PH.D., *Instructor in German*  
OLAUS DAHL, PH.D., *Instructor in Swedish and Danish*  
IRVING FISHER, PH.D., *Tutor in Mathematics*  
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ERWIN W. RUNKLE, B.A., *Lecturer on the History of Philosophy*

## GRADUATE INSTRUCTION

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THE INSTRUCTION OF GRADUATES, independently of the courses of study provided in the professional schools, had been attempted in an informal way before 1847, when such courses were definitely arranged, and the Department of Philosophy and the Arts constituted, with this object in view. The degrees of Doctor of Philosophy and Civil Engineer were first offered in 1860, that of Dynamical or Mechanical Engineer in 1873, and that of Master of Arts (previously given without evidence of study) in 1874.

Graduates of this and other Colleges and Universities, and (in exceptional cases, by special permission) other persons of liberal education, who are at least eighteen years old, are received as students for longer or shorter periods, with or without reference to the attainment of a degree.

In and after the Academic year beginning with the autumn of 1892, the degree of Doctor of Philosophy with the courses of the Graduate Department leading thereto will be open to candidates without distinction of sex.

An executive Committee has a general oversight of the students in this Department. The Committee this year is composed of Professors WHITNEY, NEWTON, BRUSH, WHEELER, LADD, and HADLEY. They receive the names of applicants for instruction, and judge and approve the courses of study proposed; and information may be obtained from them as to conditions, terms, etc. Students may also make special arrangements with any instructor according to their mutual convenience. All graduate students not regularly enrolled in any other Department of the University, are required to register their names at the Treasurer's office at the beginning of each year of study.

The attention of teachers who desire to fit themselves more thoroughly for a higher grade of professional work,

is called to the advantages offered by this Department for pedagogical instruction and discipline. In addition to the special and advanced study of the subjects in which the graduate student desires instruction, and the pursuit of courses in psychology, ethics, philosophy, and of other courses cognate with pedagogy, opportunity will be afforded to observe the actual practice in the class-room of expert and successful instructors, as well as the organization of the different departments of the University and their methods of work.

Instruction is given partly by lectures, partly by recitations and by oral and written discussions, partly by directing courses of reading, and partly by work in the laboratories and with instruments. There are also various voluntary associations, in which instructors and students meet together periodically for the reading of papers, oral discussions, etc.; such are, the Classical Philology Club, the Mathematical Club, the Political Science Club, the Philosophical Club, and the Modern Language Club.

The terms and vacations correspond with those in the Undergraduate Departments. The Academic year opens Thursday, September 29, 1892.

The fee for instruction is generally one hundred dollars; but it may be more, or less, according to the courses pursued and the amount of instruction received.

Students have the free use of the Library of the University (including the Linonian and Brothers Library), and are admitted to the College Reading Room on payment of an annual fee of two dollars. The University Library contains over 150,000 volumes, and many thousands of unbound pamphlets. Of current periodical publications, including publications of learned societies, the Library receives an unusually large number,—the foreign serials alone being not less than five hundred. The Linonian and Brothers Library contains 31,000 volumes. The whole number of volumes in the several libraries of the University is over 200,000.



The Reading Room receives forty-six daily newspapers, American and foreign, fifty weeklies, and seventy other periodicals,—in addition to the periodicals received at the University Library.

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THE DEGREE OF DOCTOR OF PHILOSOPHY is conferred upon those who, after having taken a Bachelor's degree (implying a course of undergraduate study equivalent to that pursued in the Academical Department), and having studied in this Department for not less than two years, shall have passed a satisfactory final examination and presented a thesis giving evidence of high attainment in the branches of knowledge pursued. The thesis must be deposited at the Library for public inspection, not later than June 1. The degree is not given, upon examination, to those whose studies are pursued elsewhere. The requirements for a degree in many cases exact of the student more than two years of labor; especially when the course of undergraduate study has been less than four years. A good knowledge of Latin, German, and French, is required in all cases, unless, for some very exceptional reasons, the candidate be excused by the Faculty. The fee for graduation is ten dollars.

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THE DEGREE OF MASTER OF ARTS is conferred on Bachelors of Arts of Yale College or of other Colleges, of two years' standing or upwards, who have given to the Faculty of the Academical Department evidence of having made satisfactory progress in liberal studies after receiving their first degree. Such evidence may be furnished by one year's systematic study (not professional) in New Haven, under the direction of the Academical Faculty, followed by an examination. Graduates of other Colleges can obtain the degree only by residence as thus described.

Such Bachelors of Arts *of Yale College* as may not choose to reside at the College for the prosecution of study may

show at any time, not less than three years after graduation, by their printed essays, or by submitting to special examinations, that they have spent a year in liberal (and non-professional) study, and are worthy of recommendation for this degree.

A committee of the Faculty is appointed (consisting for the present year, of Professors NEWTON and WHEELER), to whom candidates for this degree must submit their proposed courses of study for approval by the first of November in each year; and the evidence of a year's study must be submitted to the same committee by June 1.

In the case of resident students, the charge for instruction will usually be one hundred dollars, with a fee of ten dollars for the degree. In the case of non-residents, the fee for examinations and the degree will usually be twenty-five dollars.

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THE DEGREES OF CIVIL ENGINEER AND MECHANICAL (OR DYNAMICAL) ENGINEER are conferred on Bachelors of Philosophy who have taken the first degree in Engineering study, and who pursue a higher course under the direction of the Governing Board of the Sheffield Scientific School, for at least two years, sustaining a final examination, and giving evidence of their ability to design important constructions and to make the requisite drawings and calculations. The fee for graduation is five dollars.

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FIVE FELLOWSHIPS yielding \$400 each, and twenty Scholarships yielding \$100 each, have been created by the Corporation out of the income of University funds. These fellowships and scholarships are open to graduates of all colleges; but in the case of the fellowships, preference is given to those who have already spent at least one year in graduate study. Candidates for these appointments should send their applications, accompanied by letters of recommendation and other evidences of the excellence of their work already accomplished, to some member of the Executive Committee, not later than June 10th.

## COURSES OF GRADUATE INSTRUCTION

Courses marked with an asterisk (\*) are undergraduate courses, but are open to graduate students, provided that they have the consent of the instructor and the approval of the Faculty.

The number of hours stated means, in every case, hours of exercises, lectures, or recitations; each week.

### I. PSYCHOLOGY; ETHICS; PHILOSOPHY

Professor LADD :—

- 1 *Introduction to Philosophy.* 2 hrs. both terms.

This course is designed for all graduate students who desire any acquaintance with philosophy, whether they make it a matter of special study or not. It may be taken for purposes of general culture; since it will provide for a brief survey of all the principal problems of philosophy, in an elementary way. One hour each week will be occupied by the instructor with a lecture. The other exercise will consist of discussions and reading of papers, in which each member of the class is expected to take part. The course will follow the order of topics in Ladd's "Introduction to Philosophy," which will be supplemented by the study of several of Lotze's "Philosophical Outlines," and by references to other books.

During the latter half of the year special emphasis will be laid upon the philosophy of life and of conduct, in connection with the discussion of problems in Ethics, Aesthetics, and the Philosophy of Religion.

- 2 *Kant Seminary.* 2 hrs. both terms.

The class meets one evening each week for the study of Kant. During the year the Critique of Pure Reason and the Critique of Practical Reason will both be read. An expository and critical lecture of about thirty minutes will, in general, precede the discussion, by the teacher and by the class, of each passage. The aim of the course will be, first, to interpret and, second, to judge critically the Kantian system of thought.

3 *Philosophy ; Modern Pessimism.* 2 hrs. both terms.

This course will consist of the critical study of Schopenhauer's "The World as Will and Idea." The study will be conducted mainly by the seminary method ; and its aim will be, not only to estimate correctly the answers given by the author to the various problems of philosophy, but also to judge of the ground on which the modern form of Pessimism bases its conclusions, as well as of its effect upon conduct, art, and the religious life.

\*4 *Readings in Philosophy.* 2 hrs. both terms.

Several of the most recent and quickening books on the different aspects or problems of philosophy will be rapidly read during the year. It is probable that Professor Royce's "The Spirit of Modern Philosophy" will first be selected. Other books to be read may be determined by the philosophical literature of the year, or by the needs and wishes of the class. The readings will be accompanied by lectures, discussions, papers, etc. The design of the course is to secure a somewhat special acquaintance with the current thoughts of the year on philosophical questions.

Assistant Professor DUNCAN :—

5 *Advanced Psychology.* 2 hrs. both terms.

Sully's "The Human Mind" will be read as a basis for examination of the principal topics in this subject. Especial attention will be paid, by supplementary reading and by discussions, to recent investigations and advances in empirical psychology.

Dr. SNEATH :—

6 *Psychology and Philosophy of Education.* 2 hrs. both terms.

a. A thorough study of the psychological basis of education. This will include a careful analysis of the mental processes ; a study of the chronological development of the mental powers, of the dependence of the higher psychical activities upon the lower, of the interdependence of the powers of the mind, and the measurement of mental faculty in its relation to the theory and practice of education. Special attention will be given to the psychology of attention, habit, interest, etc. The physical and social environment, heredity, sex, temperament, as bearing on education will receive due attention. Sully's "Outlines" and "Teacher's Handbook of Psychology," Galton's "Inquiries into Human Faculty," Waitz's *Allgemeine Paedagogik*, etc.

b. A careful study of the philosophical basis of education. Rosenkranz's "Philosophy of Education."

Special topics will be investigated by members of the class, the results of which will be presented in the lecture room.

[Early in next year, laboratory work in experimental and physiological psychology, under a special and competent instructor, will be opened to graduate students,—comprising the following two courses :]

Dr. ——— :—

7 *Experimental and Physiological Psychology.*

2 hrs. both terms.

This course will provide for a study (illustrated by charts, models, histological preparations, and a certain amount of laboratory work) of the human nervous mechanism, and of the principal relations which exist between changes in this mechanism and the activities of the mind. The text-book: Ladd's "Elements of Physiological Psychology."

8 *Special Problems in Psychology.*

Under the guidance, and with the assistance, of the instructor, particular problems in experimental and physiological psychology may be worked out in the laboratory. Such work will be permitted to count for the degree of Doctor of Philosophy, according to its excellence and the amount of well-spent time devoted to it. It is expected also that, in certain cases, theses for this degree may be prepared as giving the results of such work.

[Attention is called to the fact that those who wish to study psychology from this point of view, with great thoroughness and detail, or with the design to fit themselves for the work of teachers, may take allied courses in physics, physiology, and biology, whether offered by the Graduate Department or by the Medical School.]

Dr. JACOBSON :—

9 *Swedish Philosophy.*

2 hrs. both terms.

A careful study of the development of speculative thought in Sweden will be made, with frequent reference to writers of Denmark and Norway. Lectures will be accompanied by discussions and papers prepared by the class.

Mr. BUCHNER :—

10 *Educational Practice.*

2 hrs. both terms.

This course will comprise—

1. *Methodology*: A summary study of the laws of mental development as including the principles common to all methods; and a historical and critical examination, to determine the best methods applicable to the different main branches of instruction. Compayré's *Lectures on Pedagogy*.

2. *Organization*: The educational legislation, administration, and internal organization, pertaining to primary, secondary, and technical schools, and to the principal Universities in Europe and America,—including a historical survey of their rise and development.

Constant reference will be made to National Educational Reports, Sonnenschein's "Educational Codes of Foreign Countries," Bardeen's "Common School Laws," Klemm's "What I Saw in European Schools," Laurie's "The Rise and Early Constitution of Universities."

Mr. RUNKLE:—

11 *British Philosophy.* 2 hrs. both terms.

The course of speculative thought in Locke, Berkeley, and Hume will be traced. Careful study of selected writings of these authors will be made, accompanied by discussions and lectures. The aim will be to consider them, not only in themselves but also in their relations to the subsequent development of philosophy in the Scottish and Kantian Schools.

[The following courses in the Divinity School are also open to graduate students of philosophy, on obtaining, in each case, permission from the instructor.]

Professor HARRIS:—

12 *The Philosophical Basis of Theism and the Self-Revelation of God.* 2 hrs. both terms.

A course of lectures on these topics will be accompanied by a study of the text-books bearing the same names. The course is primarily designed for Juniors in the Divinity School.

13 *Special Studies in the Philosophy of Religion; or Christian Ethics.*

This course is primarily designed for graduates of the Divinity School.

Professor FISHER :—

14 *Evidences of Christianity.*

The testimonies of the early ecclesiastical writers relating to the Gospels will be examined ; or Weiss's *Life of Jesus* will be read, with references to Beyschlag, Weizsäcker, and other recent authors.

Dr. FAIRBANKS :—

15 *History of Social Ethics (half-course).*

2 hrs. 1st half-year.

The effort will be made to trace the growth of the moral ideal as this was actually felt by the people. The popular conceptions of duty and its sanctions, of sin and its penalty, and the concrete duties in relation to these conceptions, will be discussed with reference to their development. Special attention will be paid to the Hebrews and to the Old Testament ethical standards ; to the social ethics of Greece ; and to the influence of Christianity upon these.

16 *Comparative Religion (half-course).* 2 hrs. 2d half-year.

(a) Two or three types of religion among uncivilized tribes (the North American Indians and the Negroes) will be studied, and the different theories as to the origin of religion will be criticised. (b) Under the *History of Religion*, the religions of India and Persia will be studied, and on this basis the effort will be made to trace some of the laws that govern the development of religion, and the factors which tend to aid or hinder such development. (c) The *Phenomenology of Religion*, including a discussion of rites and ceremonies, objects of worship, etc., and the connection with these of the real development of religion.

17 *Philosophy of Religion.*

This course of lectures is primarily designed for graduates of the Divinity School.

[For courses in Plato and Aristotle, see *Classical Philology*, courses 6, 8, and 16 ; for *Ethics as a Political Science*, see *Political and Social Science*, course 8.]

## II. POLITICAL AND SOCIAL SCIENCE AND HISTORY

Professor SUMNER :—

- 1 *Finance and Politics in the History of the United States.* 2 hrs. both terms.

This course deals with the history of the United States as a field for the study of currency, banking, tariff, public finance, the history of political economy, the art of politics, the science and art of government, and industrial history. It occupies two years. In 1892-3 the first part, to 1825, will be given. It is assumed that those who attend this course have a good knowledge of the civil history of the United States.

- 2 *The Historical Development of the Industrial Organization.* 2 hrs. both terms.

Including the transformation of the system of production from the manor and guild system to the wages system; the transformation of commerce by the opening of the world-market; the invention and improvement of credit institutions; the development of transportation and means of communication. In connection with these subjects, attention will be given to the evolution of economic doctrine, and to the social effects of the economic changes.

- \*3 *Social Science.* 2 hrs. both terms.

A very elementary course in Anthropology and Ethnology, with the origin of civilization and the development of social institutions. The object is, by a scientific study of human society, to acquire a standpoint for the study of social problems. Those who are able to read difficult French or German may join special divisions to read text-books in those languages. For such divisions the course will be counted as a three-hour course. The French text-book will be Quatrefages' *Histoire Générale des Races Humaines*; the German text-book will be Lippert's *Kulturgeschichte*. These books must be obtained by the students before the beginning of the fall term.

Professor FARNAM :—

- 4 *The Principles of Public Finance.* 2 hrs. 2d term.

A systematic survey of the means by which the expenditures of government are met, regard being had both to the economic prin-



ciples involved and to the fiscal systems of modern states. Leading topics are: the budget, taxation (national and local), public debts, and state banks considered as aids to public credit.

5 *The History of Labor Organizations.* 2 hrs. 1st term.

In this course the development of associations of artisans from the origin of the guild system to the present day will be traced. Particular attention will be paid to their relations to the arts, their influence on the welfare of the laboring classes, their connection with the governmental regulation of industry, and their bearing on some practical problems of the day.

Professor HADLEY :—

\*6 *Economics (Elementary Course).* 2 hrs. both terms.

A general introduction to the science. Walker's Political Economy will be used as a text-book supplemented by lectures and discussions of the more important problems of theory and practice.

7 *Relations between Economics and Law.* 1 hr. both terms.

With special reference to corporate finance and railroad rates.

8 *Ethics as a Political Science.* 1 hr. 1st term.

A historical study of the development of moral and legal standards in their relations to one another.

9 *Recent Economic Discussion.* 1 hr. 2d term.

A critical study of books and monographs on selected topics of economic science. Special attention will be paid during the coming year to capital and interest. The members of the class are expected to take their full share in special preparation for these discussions.

Professor HADLEY, Dr. SCHWAB, and Dr. FISHER :—

\*10 *Economics (Advanced Course).* 3 hrs. both terms.

This course is intended for those who have special interest in the subject, and will be divided into sections small enough for effective oral work of recitation and instruction. Each section will meet each of the officers named during part of the year. Professor Hadley will give instruction in the History of Political Economy with special reference to modern Economic Theories, using as text-books Jevons' Theory of Political Economy and Sumner's Economic Problems. Dr. Schwab will give instruction in the

principles of Currency, Banking, Taxation, and Public Debts, with special reference to the financial history of the United States, using as text-books Jevons' Money, Dunbar's Banking and Adams' Public Debts. Dr. Fisher will give instruction in the Tariff History of the United States; this will include a discussion of the general theory of international exchange, its effect on prices and distribution; the history of the protection sentiment and the various theories of protection; Taussig's Tariff History of the United States will be used as a basis.

Dr. SCHWAB :—

\*II *Economics.*

1 hr. both terms.

The financial history of the United States since 1860 will be the subject of class-room work for the year, but provision will be made for those who prefer to pursue investigations in other departments of Economics. Each student will be expected to investigate an assigned topic thoroughly, and to prepare a series of papers upon it. No one will be admitted who does not take course 10.

12 *United States Public Finance.*

2 hrs. 1st term.

The principles of government revenue and their application to the finances of the United States, especially to State, County, Township and City finances. Leading topics are: the spheres of expenditure and revenue of the different political units of the United States; their fiscal policy; historical and critical study of their forms of revenue; public lands, government monopolies, fees, licenses, taxes and loans; the American system of State and local taxation in theory and practice; State and local debt financiering.

13 *Investigation Course.*

1 hr. 2d term.

General topics in the financial history of the United States will be assigned for individual investigation by the students. The results will be presented and discussed at the meetings of the class.

Dr. FISHER :—

14 *Insurance.*

2 hrs. both terms.

Mathematics, Economics, and History of Insurance. (1) Mortality statistics used in computation of premiums by the theory of chances. Contrasted character of Life, Fire, and Marine statistics and risks. Reinsurance. (2) Economic function and utility of

insurance. Discrimination of good and bad forms of insurance. speculation and gambling. Connection of insurance with interest and credit. (3) Greek Bottomry. Hanseatic and Lombard Insurance. Development in England and America. Recent branches of Insurance. Governmental and legal aspects.

\*15 *Mathematical Theory of Prices.* 1 hr. both terms.

Analytical, graphical, and mechanical methods applied to production, consumption, exchange, and the determination of prices. Jevons' Theory of Political Economy will be used as a basis. Students acquainted with German and French read parts of Auspitz und Lieben, *Untersuchungen über die Theorie des Preises.* and Walras, *Éléments d'économie politique pure.*

Instruction will be given in the conceptions and processes of the Calculus (covering 50 pages from Loomis's Elements), sufficient to enable the student to understand their applicability to social problems.

Professor BREWER :—

16 *Physical Geography in its relation to Political History.*

1 hr. 1st term.

A course of about ten lectures discussing the following topics :

1. The relations of man to the region he inhabits. 2. The physical conditions and natural productions necessary for civilization.
3. Natural aids to the defence and protection of communities.
4. Natural facilities for commerce. 5. How the influence of natural conditions is modified by modern inventions.

Professor A. M. WHEELER :—

\*17 *History of Europe since 1789.* 2 hrs. both terms.

Mainly political ; introductory to European politics of our day.

\*18 *English History.* 3 hrs. both terms.

Political and constitutional. Particular attention is given to the origin and development of the system of self-government. The course is of especial value to those who intend to study law.

19 *English History.* 2 hrs. both terms.

This course covers two years. The object is to trace carefully the long, continuous, and, on the whole, orderly development of English political institutions. Special topics are assigned, and the best sources of information indicated. Particular attention is devoted to the early and medieval periods, and for these the work of Bishop Stubbs will be the leading authority.

Professor C. H. SMITH :

- \*20 *American History (Colonial).* 2 hrs. both terms.  
Exploration and early settlement of North America, and colonial history to the close of the revolutionary war.
- \*21 *American History (Political).* 2 hrs. both terms.  
Political History of the United States to the inauguration of President Hayes.
- \*22 *American History (Constitutional).* 2 hrs. both terms.  
An historical study of the federal and state constitutions to the present time.
- 23 *American History.* 2 hrs. both terms.  
A general course covering the colonial and national periods, intended for those who cannot give the time required by the three undergraduate courses.
- 24 *American History.* 2 hrs. both terms.  
A special course intended only for those who have a good general knowledge of our history, and who wish to make a careful study of some limited period or topic of their own selection.

Professor ADAMS:—

- \*25 *Medieval History.* 2 hrs. both terms.  
The object of the course is to furnish an outline of the general history of Europe, and to follow the development of political, intellectual, and religious civilization through the period which lies between ancient and modern history.
- \*26 *Europe from 1520 to 1789.* 2 hrs. both terms.  
The history of Europe from the Reformation to the French Revolution. Especial attention is given to the political history.
- 27 *The Age of the Renaissance.* 1 hr. both terms.  
The founding and development of universities, the revival of learning, the awakening of the critical spirit and its application to old beliefs, the age of discoveries, and the beginning of modern physical science.  
The work will consist in the careful study of assigned topics upon which reports will be made to the class. These topics will be so arranged that, combined with the lectures given, they will

form a continuous history of the period. In the presentation of these reports the student is expected to assume, for the occasion, the position of an instructor, and to have constantly in view in his study of the subject, the most effective method of teaching it to a class. The criticisms and suggestions of the other members of the class and of the instructor will be directed not merely to the subject matter but also to the method of presentation.

This may be made a two-hours course by any one who wishes to do extra work in the subject, and it is understood that the sessions of the class may extend to two hours.

28 *Investigation Course.*

The investigation of special topics in the field of European history. The topics to be studied may be selected by the student with the approval of the instructor. Occasional meetings of those who take the course will be held for the discussion and illustration of the methods of historical investigation and criticism, and it will be the object of the course to impart a knowledge of these methods as well as of the special facts investigated.

[The following course in the Divinity School is also open, by the special permission of Professor Fisher, to graduate students.]

Professor FISHER :—

29 *General Church History.* 3 hrs. both terms.

This course comprises the following topics: The nature, divisions, and sources of Church History, with a review of the literature on the subject; the Old or Preparatory Dispensation in its relation to Christianity; the condition of the Græco-Roman world at the introduction of the Gospel; the establishment of Christianity, and the conflicts of the Apostolic Age; the spread of Christianity, including especially the conversion of the Roman Empire and of the Teutonic nations; the changes in ecclesiastical polity in the early centuries; the organization of Latin Christianity under the Papacy; the relations of the Papacy and the Church to civil society in the Middle Ages; the Protestant Reformation, with its causes and the systems of Polity adopted by the different Protestant churches; Christian life, and its characteristic features in the successive eras (including the rise and subsequent history of monasticism); the history of Christian worship.

[For Athenian Political and Legal Institutions, see Classical Philology, course 13.]

### III. ORIENTAL LANGUAGES AND BIBLICAL LITERATURE

Professor WHITNEY :—

- 1 *Sanskrit.* 4 hrs. both terms.  
Instruction in Sanskrit, beginning with the instructor's Sanskrit Grammar, and passing on to Lanman's Reader, etc., and to various branches of the literature, whether Vedic or classical, as may suit the advancement and the tastes of the student.

President DWIGHT :—

- \*2 *The Epistles of Paul.* 1 hr. both terms.  
A study of these Epistles as connected with the development of the thoughts of the writer.

Dr. SANDERS :—

- \*3 *Hebrew (first course).* 4 hrs. 1st term.  
Genesis i-iv, and with these chapters, (a) the etymological principles of the language; (b) the translation of Hebrew into English and English into Hebrew; (c) the acquisition of a moderate vocabulary.
- \*4 *Hebrew (second course).* 2 hrs. 2d term.  
Genesis v-viii studied in detail, Exodus i-xix more rapidly, with especial attention to (a) the mastery of the etymology, (b) the general principles of syntax, (c) the principal prose accents.
- \*5 *Hebrew (third course).* 2 hrs. 2d term.  
The critical translation of portions of the Books of Samuel in connection with (a) lectures on the history and peculiarities of the Hebrew language, and on the simple principles of textual criticism; (b) rapid sight-reading in historical Hebrew.
- \*6 *Arabic.* 2 hrs. both terms.  
The Arabic version of Genesis i-iii (Lansing's Arabic Manual), and with these chapters the principles of the language; reading of selected Suras of the Qurân; lectures on early Arabian civilization, Arabic literature, the structure and contents of the Qurân, and the history of Islam.

- 7 *The Suras of the Earlier Periods.* 2 hrs. 1st term.

A rapid reading of the early Suras of the Qurân in chronological order with special reference (a) to the determination of its pre-Islamic elements, (b) a comparison of the ideas of each period, (c) the spiritual history of Mohammed.

- 8 *Arabic Literature.* 2 hrs. 2d term.

Reading of selections from prose and poetical literature, using a chrestomathy and selected works, with lectures on the history and literature of Arabia since the time of Mohammed.

- 9 *The Beginnings of Hebrew History (University Lecture).* 1 hr. 2d term.

A series of lectures on the origin and development of the Israelitish nation, including a brief survey of the history and characteristics of Semitic civilization, a consideration of the light thus thrown upon the beginnings of the Hebrew nation, and an examination, from a strictly historical standpoint, of the statements of the Biblical histories from the 12th chapter of Genesis to the close of the Book of Judges.

- \*10 *The Minor Prophets.* 1 hr. both terms.

A study of this portion of the English Bible as literature. It will include the historical environment of each prophet, the analysis and paraphrase of his prophecy, a study of the literary characteristics, the constructive ideas and the permanent teaching of his sermons, and a survey of the prophets as related to one another.

- \*11 *Old-Testament Psalm and Wisdom Literature.* 2 hrs. both terms.

This course comprises (a) a study of the Psalter, including the personal, historical and literary elements, its formation and its ideas; (b) a similar study of the books of Hebrew Wisdom, Proverbs, Job, and Ecclesiastes; (c) the place of the sages in the Israelitish polity, as distinguished from the prophets and priests; (d) Israelitish philosophy in its relation to modern thought.

Dr. ——— :—

- 12 *Hebrew Readings.* 2 hrs. both terms.

Reading at sight in selected portions of the Hebrew Bible.

- 13 *The Post-Exilic Prophets—Haggai, Zechariah, Malachi.* 2 hrs. both terms.  
A textual and syntactical study, including also careful exegesis and consideration of the historical material connected with these prophecies.
- 14 *Assyrian Language.* 2 hrs. 1st term.  
This course includes (a) the grammatical principles, (b) mastery of the most common cuneiform signs, (c) reading of transliterated and cuneiform text. Lyon's *Assyrian Manual* is used as a textbook with constant references to Delitzsch's *Assyrian Grammar*.
- 15 *Assyrian Historical Inscriptions.* 2 hrs. 2d term.  
The critical interpretation of the inscription of Tiglathpileser I, accompanied by a rapid reading in Schrader's transliterated texts of the other early inscriptions.
- 16 *Babylonian Historical Inscriptions.* 1 hr. both terms.  
Including inscriptions of Nebuchadnezzar, Neriglassar, and Nabonidus.
- 17 *Assyro-Babylonian History.* 1 hr. both terms.  
Including (a) lectures on Assyro-Babylonian history, (b) readings in the Book of Kings with comparison of the cuneiform inscriptions.

[The following Semitic courses in the Theological Seminary are open to graduate students with the consent of the instructor.]

Professor CURTIS :—

- 18 *Hebrew for Beginners.* 5 hrs. both terms.  
Elements of the Hebrew language including the laws of the vowel changes, the structure of the verb, the formation of nouns, the acquisition of a vocabulary according to the etymological method, and the leading principles of Hebrew Syntax ; with exercises in sight reading, and the critical translation of Genesis and Exodus i-xxiii.
- 19 *Psalms and Isaiah.* 2 hrs. both terms.  
Reading of selections with special reference to Hebrew Syntax and Biblical Interpretation.



- 20 *Job.* 1 hr. both terms.  
A critical study of the poem including reference to the structure of Hebrew Poetry and the thought of the O. T. Wisdom Literature.
- 21 *Hexateuchal Criticism.* 1 hr. 2d term.  
An examination of the evidence for the documentary composition of the Hexateuch, and the theories of its explanation.
- 22 *Old Testament Introduction.* 1 hr. both terms.  
The history of the Old Testament Canon, and of the separate O. T. books with a summary of their contents, and also an account of the text and Versions of the Old Testament.
- 23 *Old Testament Prophecy.* 1 hr. both terms.  
Study of Old Testament Prophecy with especial reference to the Messianic element.

Professor DAY :—

- 24 *Syriac and Biblical Aramaic.* 1 hr. both terms.  
Instruction in Syriac Grammar followed by readings in the Peshito version and also in Biblical Aramaic.
- 25 *The Hebrew New Testament.* 1 hr. both terms.  
Critical reading of Delitzsch's Hebrew version of the New Testament, compared with the latest revised versions in respect to text and interpretation.

Mr. VAN NAME :—

- 26 *Japanese.* 1 or 2 hrs. both terms.  
Elements of the Japanese language, and exercises in the reading of both transliterated and native text.

#### IV. CLASSICAL PHILOLOGY

Dr. OERTEL :—

- 1 *Comparative Philology.* 2 hrs. both terms.  
Lectures on Comparative Philology with special reference to Latin and Greek Phonology and Morphology.

Professor SEYMOUR :—

- 2 *The Greek Orators.* 3 hrs. both terms.  
A study of Greek Oratory, beginning with the orations of Isaeus, and including some of the private orations of Demosthenes, with reference to Athenian life and law, as well as to the development of Attic eloquence.
- 3 *Pindar and the Lyric Fragments.* 2 hrs. 1st half year.  
With reference to poetic forms, the relations of the colonies to the mother cities of Greece, the festal gatherings, and their importance, etc.
- 4 *Homer.* 2 hrs. 2d half year.  
A critical but familiar interpretation of portions of the *Odyssey*.
- \*5 *Homer.* 2 hrs. 1st term.  
Introduction to the critical study of Homer. Lectures on the history of Homeric study, Epic poetry, the composition and transmission of the poems, life in the Homeric times in its various aspects. Homeric language and verse. Interpretation of the first books of the *Iliad*.
- \*6 *The *Phaedo* of Plato.* 2 hrs. 1st term.  
Introduction to the literary and philosophical study of Plato; observing carefully the dramatic character of the work, the connection of thought and the marks of division in the argument, with special attention to the characteristics of Plato's style.
- \*7 *Theocritus.* 2 hrs. 2d term.  
The bucolic and dramatic idyls, the addresses to Ptolemy and Hiero, and the more important of his other poems will be read, with a comparison of the various imitations, and a study of the artistic composition of each poem.
- \*8 *Aristotle's *Nicomachean Ethics*.* 2 hrs. 2d term.  
Books I-IV and X, with a study of Aristotle's methods of research and statement.

Mr. KITCHEL :—

- \*9 *Thucydides. The Sicilian Expedition.* 2 hrs. 2d term.

Selection from Books VI and VII. Special attention will be paid to the characteristics of Thucydides as a writer of history, to the topography involved, and to the relation of the Sicilian Expedition to the History of Greece.

Assistant Professor CLAPP :—

- \*10 *Aristophanes.* 2 hrs. 1st term.

The *Birds* and *Frogs*. In this course the student will be introduced to the writings of the great comic poet by the careful reading of two of his most interesting works. The plays will be studied chiefly from the literary point of view, and questions of metre and scenic antiquities will be discussed only so far as may help to the fuller appreciation of what is read. The peculiarities of the Old Attic Comedy will be analyzed, and the plays contrasted with Roman and modern works.

- \*11 *Homer.* 2 hrs. 2d term.

In this course from 6000 to 8000 lines of the *Iliad* will be read, including all the most important portions of the work. The principal object will be to give the student a clear and comprehensive idea of the poem as a whole, but the last six books will be discussed with special reference to some recent views of the origin of the *Iliad*. Considerable attention will be given to the correct and intelligent reading aloud of the Greek text.

Assistant Professor GOODELL :—

- \*12 *Sophocles.* 2 hrs. 1st term.

The *Oedipus Rex*, with special attention to the artistic form, as in dramatic construction and in the use of metres.

- \*13 *Athenian Political and Legal Institutions.* 2 hrs. 2d term.

An introduction to the subject. Aristotle's *Athenian Constitution* is made the basis of the work; this is supplemented by lectures and private reading. A knowledge of German or French or both is an advantage, but is not required.

- \*14 *Topography and Monuments of Athens.* 1 hr. both terms.

The object of the course is to gain as good an idea as the time allows of the external appearance of ancient Athens and Attica. Photographs, plans, the descriptions of travelers, and the results of recent excavations are studied partly in class and partly in

private. The course includes, therefore, an introduction to Greek architecture, and, in connection with the Parthenon and other temples, some attention is given to sculpture. When but little outside preparation is required the time of the exercise may be extended to two hours.

Assistant Professor REYNOLDS :—

- \*15 *Euripides.* 2 hrs. both terms.

The Alcestis and Hippolytus, Bacchae, Iphigenia in Aulis, Ion, and Supplices. This course includes a systematic study of Euripides as a poet, with lectures on scenic antiquities, metres, and mythology.

- \*16 *Aristotle's Poetics.* 2 hrs. 1st term.

Reading and discussion of Aristotle's opinions and principles, with illustrations from modern literature.

Mr. HUNT :—

- \*17 *Herodotus.* 2 hrs. 2d term.

The second book will be read with special reference to the history, antiquities, and art of Egypt.

Professor PECK :—

- 18 *Lucretius.* 2 hrs. 1st half-year.

- 19 *Pliny's Letters.* 2 hrs. 2d half-year.

- \*20 *Early Latin.* 1 hr. both terms.

Studies in ante-classical forms, construction, and literature, based largely on Allen's Remnants of Early Latin and Merry's Fragments of Roman Poetry.

- \*21 *Cicero.* 2 hrs. both terms.

Familiar Letters, de Oratore, pro lege Manilia.

- \*22 *Hexameter Poetry.* 3 hrs. 2d term.

Ennius, Lucretius, Vergil (Georgics), Horace (Epistles).

Professor H. P. WRIGHT :—

- \*23 *Juvenal and Martial.* 2 hrs. 1st term.

Satires i, iii, iv, v, vii, viii, of Juvenal, with selections from Martial, with special reference to a study of the private life of the Romans.

Professor MORRIS :—

24 *Historical Syntax.* 1 hr. both terms.

Principles and methods of the historical syntax of the Latin modes and tenses ; discussion of text-books and of typical special investigations ; study of a single group of constructions, probably the *quod* and *quia* clauses.

\*25 *Plautus.* 2 hrs. 1st term.

The *Captivi*, with special work on metres and on the language and style.

\*26 *Reading at sight. Prose.* 1 hr. 1st term.

Readings in the later writers not commonly included in the college course. The selection will be left in part to the class.

The sessions will last two hours and no outside work will be required.

\*27 *Reading at sight. Prose.* 1 hr. 2d term.

Readings in the later poets. Similar to the preceding course.

Dr. MOORE :—

\*28 *Latin Composition.* 2 hrs. both terms.

Much time will be given to the reading of Erasmus's Colloquies. Conversation and original composition. The course is open only to those who have done superior work in Latin.

[The Classical Philology Club meets every week and spends that evening in reading and discussing the work of some classic author, with informal reports and papers on topics in the field of Greek and Latin Philology.]

## V. MODERN LANGUAGES AND LITERATURES

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- \*1 *Early French Literature.* 2 hrs. both terms.  
La Chanson de Roland; Le Roman de Renart and Le Roman de la Rose; Les Fabliaux. The drama of the Middle Ages. Le Roman de Roue and Le Roman de Rose; Villehardouin; Joinville; Froissart; Commines. Clédar's Compendium will be used.
- \*2 *Special Course of Conversation.* 1 hr. 1st term.  
Topics: The French Revolution; French Society in the XIXth Century; the Siege of Paris.
- \*3 *French Syntax and Phonetics.* 1 hr. both terms.
- \*4 *La Littérature Française.* 2 hrs. 1st term.  
La littérature française depuis la Réforme jusqu'à la Révolution. Rabelais; Montaigne; Calvin; Pascal; Corneille; Racine; Molière; Boileau; Montesquieu; Voltaire; J. J. Rousseau.
- \*5 *French Literature of the XIXth Century.* 2 hrs. 2d term.  
Chateaubriand; V. Hugo; Th. Gautier; Balzac; Flaubert; A. Daudet. Aesthetic and scientific analysis of the modern writers.
- \*6 *Spanish.* 3 hrs. both terms.
- \*7 *Italian.* 3 hrs. both terms.

Assistant Professor McLAUGHLIN :—

- 8 *Dante.* 2 hrs. both terms.  
The *Vita Nuova*, and selected cantos of the *Commedia*.

Assistant Professor CAMERON :—

- 9 *Molière, Life and Works.* 1 hr. both terms.  
(a) Theories of Molière's life, (b) Dramatic indebtedness, (c) Dramatic development, (d) Critical study, (e) Purpose of his social satire, (f) Imitators. Collateral reading. Individual papers.
- 10 *The Anecdotic History of the Seventeenth Century.* 1 hr. 1st term.  
Letters, Memoirs, Society.

Professor PALMER :—

Graduate instruction in other than these specified subjects relating to the history of the German language and of German literature will be given as far as may be feasible to individual students according to their several attainments and requirements. Application for such instruction may be made to Professor Palmer.

- 11 *Gothic.* 1 hr. both terms.

Braune's Grammar and Heyne's Ulfilas.

- 12 *Introduction to Germanic Philology.* 1 hr. both terms.

- \*13 *Schiller, Works and Life.* 2 hrs. both terms.

Rapid reading of poems, plays, and prose writings of Schiller with some investigation of his influence on German literature.

- \*14 *Goethe, Works and Life.* 3 hrs. both terms.

After an outline study of Goethe's life and development in connection with his lyric poems, his early prose writings, and his principal dramas, particular attention will be given to Faust I and II, the later prose works, and Goethe's important utterances in letters, journals, and conversations.

- \*15 *History of German Literature since 1740.*

2 hrs. both terms.

Beginning with the time of Klopstock, the development of the literature will be followed as near to the present as is feasible, with special attention to the Classical Period and the Romantic School, characteristic authors and works, and a summary view of the literature since 1832.

Assistant Professor GRUENER :—

- 16 *Middle High German (advanced course).* 2 hrs. both terms.

A course in rapid reading with a view to an acquaintance with the literature of the Middle High German epic and lyric poets. This year Hartmann's Iwein, Gottfried's Tristan and selected portions of Minnesangs Frühling will be read and interpreted.

- \*17 *Middle High German.* 2 hrs. both terms.

Hartmann; Nibelungenlied. Selected poems of Walther von der Vogelweide. Lectures and papers.

- \*18 *German Prose.* 2 hrs. both terms.

A course in rapid reading. Selections from biography, history, and critical essays.

Dr. OERTEL :—

- \*19 *German Composition and Conversation.* 2 hrs. both terms.

For practice in speaking and writing. Translation into German of narrative prose and of selections from history and literature. Special topics are assigned for discussion in German. This course is conducted in German.

Dr. DAHL :—

- \*20 *Norwegian and Danish.* 2 hrs. both terms.

The elements of the language learned inductively by reading selections from the writings of modern authors. The course is intended more especially for those who make a scientific study of English, or those who wish to obtain a general knowledge of the Teutonic languages.

- \*21 *Old Norse (Icelandic).* 1 hr. both terms.

Vigfusson and Powell's Icelandic Prose Reader will be used.

- \*22 *Swedish.* 1 hr. both terms.

Reading of selections from Tegnér's poems and the works of modern authors.

Professor LOUNSBURY :—

- 23 *English Literature.*

The English literature of the latter half of the XIVth Century, embracing Chaucer, Gower, and Wycliffe.

Professor BEERS :—

- \*24 *English Poetic Masterpieces.* 2 hrs. both terms.

Critical readings in the class-room in the text of the Canterbury Tales, the Faery Queene, the principal plays of Shakspeare, and the Poetry of Milton.

- \*25 *History of the English Drama.* 2 hrs. both terms.

The examination of representative tragedies, comedies, histories, farces and masques from Marlow to Sheridan, with some attention to modern verse-dramas by Byron, Shelley, Browning, Tennyson, Swinburne, etc.

- \*26 *History of English Romanticism from 1726 to 1890.*

1 hr. both terms.

This course is designed for special students of literary history. The instruction is given almost entirely by lectures, and examinations are held upon a somewhat extensive course of assigned reading.



Professor COOK :—

- 27 *Theories of Poetry.* 2 hrs. 2d term.  
 A course in the theories of poetry in general, and in the principles of criticism applicable to its various departments, as the epic, dramatic, and lyric. Discussions and papers on the basis of standard works, such as Aristotle's Poetics, Sidney's Defense of Poesy, Addison's Criticisms on Paradise Lost, Boileau's Art of Poetry, Lessing's Laokoon, and others of similar character.
- 28 *Old English Poetry.* 1 hr. 1st term.  
 The texts used are Judith (Cook's edition), Elene (Kent's edition), and The Battle of Maldon (Sweet's Reader). These are read, their place in the literature examined, and questions of authorship, date, and textual criticism discussed. Ten Brink's and Wülcker's Histories of Old English Literature are constantly used for reference.
- 29 *Old English Grammar.* 1 hr. 2d term.  
 An exhaustive grammatical examination of some prose text is made, on the basis of Cook's Phonological Investigation of Old English and edition of Sievers' Grammar for Phonology, of the latter for Inflection, and of March's Grammar for Syntax.
- 30 *Historical English Prosody.* 1 hr. 1st term.  
 Schipper's Englische Metrik is adopted as the basis of study, but reference is made to the discrepant views of other authorities.
- 31 *Middle English Grammar.* 1 hr. 2d term.  
 An outline of Middle English Phonology and Inflection is given by means of lectures, and the knowledge thus gained is applied in a grammatical study of Chaucer, on the basis of ten Brink's Chaucer's Sprache and Verskunst.
- \*32 *History of English Literature.* 2 hrs. 1st term.  
 An outline of the subject, on the basis of Brooke's Primer, Taine, Morley's First Sketch, and ten Brink's Early English Literature, supplemented by outside reading. Frequent preparation of brief papers on assigned topics.
- \*33 *Chaucer.* 2 hrs. 1st term.  
 Reading of selected Canterbury Tales, chiefly as literature.
- \*34 *Old and Middle English.* 2 hrs. both terms.  
 An elementary course in the beginnings and earlier development of the English language and literature. Examination of the various elements of the Modern English vocabulary, and especially of the Saxon or Germanic element. Translation of Old English

prose. Philological interpretation of selected passages by the instructor. Sweet's Anglo-Saxon Reader; ten Brink's Early English Literature; Cook's Sievers' Old English Grammar; Bede's History; Pauli's Life of King Alfred. Reading of selections from Chaucer and other Middle English writers for linguistic purposes.

- \*35 *English Essayists.* 2 hrs. 2d term.

Study of the opinions and style of selected prose authors, ranging from the Elizabethan era to the present. Frequent preparation of brief papers on assigned topics.

- \*36 *Shakespeare.* 2 hrs. 2d term.

Critical study of a few selected plays. The Leopold edition of Shakespeare; Moulton's Shakespeare as a Dramatic Artist; Schmidt's Shakespeare Lexicon; annotated editions of single plays, etc. Frequent preparation of brief papers on assigned topics.

- \*37 *Bacon.* 2 hrs. 1st term.

Bacon's Essays and Advancement of Learning. Study through paraphrase and amplification. Bacon's character, opinions, and style. His place in Elizabethan literature. Frequent preparation of brief papers on assigned topics.

- \*38 *Tennyson.* 2 hrs. 1st term.

Critical study of selected poems. Tennyson's theory of life, literary art, and place among the poets of this century. Comparative readings in other authors, and frequent preparation of brief papers on assigned topics.

- \*39 *Browning.* 2 hrs. 2d term.

Critical study of selected poems. Browning's theory of life, literary art, and place among the poets of this century. Comparative readings in other authors, and frequent preparation of brief papers on assigned topics.

- \*40 *American Literature.* 2 hrs. 2d term.

Study of selected authors, such as Emerson, Hawthorne, and Lowell, with outside reading in authors or works not undertaken in class.

Assistant Professor McLAUGHLIN:—

- 41 *Restoration Literature.* 1 hr. both terms.

Some topics in Restoration Literature that center in Dryden.

## VI. NATURAL AND PHYSICAL SCIENCE

Professors BRUSH and PENFIELD, and Mr. PIRSSON :—

1 *Mineralogy and Petrography.*

Laboratory work and blowpipe analysis and the simple chemical methods for testing minerals. Laboratory work in determinative mineralogy. Lectures in descriptive mineralogy. Lectures in crystallography, supplemented by practical work in the measurement and calculation of crystals, and the determination of their optical and physical properties. Laboratory work in petrography and the use of the microscope in the study of rocks.

Professor ——— :—

2 *History of Organisms.*

2 hrs. both terms.

An introduction to the study of the geological history and evolutions of organisms ; including a discussion of the principles of the formation, succession, distribution, and classification of geological deposits,—the nature of geographical conditions as environment for organisms,—the nature of the successive modifications of the morphological characters of organisms and the theories explaining them, as illustrated by the facts of palaeontology.

3 *Special Geology.*

2 hrs. both terms.

This course will consist of the study of special problems of Geology, by reading memoirs and treatises, by the examination of geological materials and by field work, with the preparation of essays and detailed reports.

The work for each student will be adapted to his individual tastes, previous preparations, and aims. For the general student it is intended as a training in accuracy of observation and in precision of noting and recording facts observed ; for those seeking a full knowledge of the science, it will serve as a training in the methods of scientific investigation and as a beginning in the acquirement of the facts of the science.

Professor E. S. DANA :—

\*4 *Mineralogy and Crystallography.*

2 hrs. both terms.

Practical study of mineral species by means of blowpipe analysis and other methods ; mathematical study of crystals by the methods of analytical and spherical trigonometry, as also of their optical

properties. The time is divided about equally between the two parts of the subject ; the practical exercises are prolonged to cover two hours when but little outside preparation is called for.

- 5 *Descriptive Mineralogy.* 1 hr. both terms.  
Advanced course in the study of mineral species.

Dr. BEECHER :—

- 6 *Invertebrate Palaeontology.* 2 to 4 hrs. both terms.  
1. The study of extinct fauna by means of collections of fossils from different localities.  
2. Systematic study of the structure of a group of fossil organisms.

Professor A. W. WRIGHT :—

- \*7 *Physics.* 2 hrs. both terms.

Two exercises each week, chiefly practical work in the Sloane Physical Laboratory, with measurements, especially in heat, light and electricity, each exercise occupying two hours. As introductory to the laboratory practice, the exercises during a portion of the first term, consist of recitations or discussions upon the theory and methods of physical measurements, the use of instruments, and other special topics. Laboratory facilities are also freely accorded to students of the course at other times than those of the stated exercises. Kohlrausch's Physical Measurements ; Glazebrook and Shaw's Practical Physics ; Stewart and Gee's Practical Physics ; Ayrton's Practical Electricity ; Kempe's Handbook of Electrical Testing ; Everett's Units and Physical Constants, etc.

- 8 *Experimental Physics.*

Direction of practical work in the Sloane Physical Laboratory, with instruction in the principles and methods of physical investigation, the processes and instruments of measurement, and the methods of computing and reducing results of observations. Special attention is paid to practical measurements in optics, electricity, and magnetism. The student is expected to make original investigations an important part of his work, and has the free use of the laboratory facilities for carrying them on.

The Laboratory is thoroughly equipped for the experimental study of Physics, and for the prosecution of physical researches.

Professor HASTINGS :—

9 *Physics.*

Laboratory work, supplemented by lectures on the theory of observation, with the method of least squares. Each year, some special department of physics will be selected for detailed treatment in a course of lectures and conferences. Lectures on the theory of electricity and electrical instruments occupy six months. The use of the laboratory is at the command of the student at all times.

[For courses in Mathematical Physics, see Pure and Applied Mathematics, courses 10-13.]

Professor JOHNSON :—

10 *Agricultural Chemistry.* 2 hrs. both terms.

The Atmosphere, Water, and Soil, in their various relations to vegetation ; Tillage ; Fertilizers ; Rotation of crops ; Irrigation.

Professor GOOCH :—

\*11 *Experimental Inorganic Chemistry.* 3 exercises both terms.

Practical laboratory work, lectures, and written exercises. An introduction to elementary chemical theory, the use of symbols and formulae, and the descriptive study of the elements and their compounds.

\*12 *Experimental Organic Chemistry.* 3 exercises both terms.

An introduction to the study of the compounds of carbon. Laboratory work with lectures. Open only to those who have previously covered the ground of Course 11.

\*13 *Analytical Chemistry (first course).* 3 exercises both terms.

Laboratory practice in the ordinary processes of qualitative analysis, with lectures. Open to those who have previously covered the ground of Course 11.

\*14 *Analytical Chemistry (second course).*

2 exercises both terms.

Laboratory practice in the simpler methods of volumetric and gravimetric quantitative analysis. Open to those who take Course 13, or have taken it previously.

15 *Analytical Chemistry (third course).*

3 exercises both terms.

Laboratory practice and the study of the more complex or special problems of quantitative analysis.

16 *Theoretical Chemistry.*

1 hr. both terms.

The reading and discussion of modern theories and current chemical doctrines. Open to students who have had sufficient preliminary training.

17 *Original Work and Research.*

The facilities of the Kent Chemical Laboratory with the opportunity to engage in special lines of investigation under supervision are placed at the disposal of students sufficiently advanced to undertake such higher work.

In these courses a single laboratory exercise lasts two hours at the least, and in all-courses involving laboratory work a special fee is charged to cover the cost of materials used.

Assistant Professor WELLS :—

*ANALYTICAL CHEMISTRY.*

The analytical laboratories are open to students in term time from 8.30 to 1, and from 2 to 5 o'clock every week-day except Saturday. The greater part of the instruction is given in the laboratory to each student separately, but the various classes have, in addition, one or two familiar lectures or recitations a week, in connection with the studies pursued in the laboratory.

18 *Qualitative Analysis.*

first term.

Embraces a study of the commonly-occurring elements in their qualitative relations, and includes a systematic course of analysis for the same. A good knowledge of elementary chemistry is a necessary preparation for this. If desired, the course will be extended to include a study of many of the rare elements.

19 *Quantitative Analysis.*

This is open only to those who have taken course 18 or its equivalent.

(a) *Gravimetric Analysis.* Second term. Embraces a series of exercises involving a considerable variety of important methods.

(b) *Volumetric Analysis.* First term. This follows the gravimetric analysis. It includes the most important and typical methods.

20 *Advanced Quantitative Analysis.*

(a) *Ultimate Organic Analysis.* First term.

(b) *Metallurgical Chemistry.* The analysis of ores, fuels, fluxes, alloys, metals and other furnace products.

(c) *Mineralogical Chemistry.* The analysis of minerals for scientific purposes.

21 *Metallurgy and Assaying.* 2d term.

A course of lectures on elementary metallurgy, followed by a short course of demonstrative lectures on gold and silver assaying, with the practical application of assaying to a few typical ores.

22 *Technical Gas Analysis.* 2d term.

A short practical course, including the principal methods.

23 *Investigations in Inorganic Chemistry.* both terms.

Opportunities will be offered to those who have had sufficient preparation to make researches on analytical methods, the preparation and investigation of chemical compounds and other scientific problems.

In addition, instruction is given, when desired, in Vapor-Density Determination, Spectroscopic Analysis, and in other physical methods used in connection with chemistry.

Mr. COMSTOCK :—

24 *Organic Chemistry.*

Graduates without previous training in organic chemistry will be received into the undergraduate course of lectures and recitations. Those with sufficient laboratory experience in general and analytical chemistry have the opportunity to familiarize themselves with the general synthetic methods of organic chemistry, and may afterwards undertake such research work as seems best.

Professor EATON :—

\*25 *Pteridology and Bryology.* 2 hrs. both terms.

This course begins with practical work in the dissection and examination of vegetable tissues, with especial reference to the structure of ferns and mosses. After some facility has been gained in this kind of work, the time will be devoted to the examination of as many mosses as possible, with a view to becoming familiar with the genera and with a large number of species. Those who take this course will be expected to devote considerable time to field-work and to making collections for their own use. The course is limited to those who have taken a preliminary course in the study of flowering plants.

26 *Botany.*

At present there are no facilities for the profounder study of Vegetable Physiology. Structural Botany is taught in a practical way to the extent of preparing and examining microscopic specimens of the various tissues and elements found in phaenogams, and in cryptogams, exclusive of fungi, including the use of the ordinary solvents, dyes, reagents, and mounting media used in this study. For the study of the North American Flora generally, and the higher orders of cryptogams, with regard to their identification and geographical distribution, the facilities are excellent, and, under proper restrictions, students may have the privilege of consulting the very extensive private collections of the professor in charge.

Professor VERRILL :—

27 *Zoology.*

This course includes laboratory practice, recitations, readings, and lectures. The laboratory work is varied according to circumstances, in order to accommodate, as far as possible, those students who may wish to pursue special branches. A large part of the time is usually devoted to Comparative Anatomy, Morphology, and Systematic Zoology. Ample collections in the Peabody Museum, representing all classes of animals, are available for instruction, while the proximity to the sea makes it easy to provide fresh or living examples of most classes of marine animals for study and dissection.

Professor S. I. SMITH :—

\*28 *Elementary Anatomy and Histology.* 4 hrs. 1st term.

Four exercises, of a minimum of two hours each. Laboratory work and informal lectures. The time is devoted principally to dissections of the frog, and work with the microscope on the lower plants and animals, and in vertebrate histology, with special reference to the rudiments of biology and the elements of the morphology of animal tissues. The student is required to make microscopical preparations, keep careful records of his work, and pass frequent examinations.

\*29 *Comparative Anatomy and General Biology.*

Laboratory instruction is given with special reference to preparation for medical studies or as a preparation for further biological study and investigation. The instruction is adapted as far as possible to the special wants of the individual student.



During the last part of the second term, graduate or special students may attend the short course of lectures on embryology, with special reference to human morphology, given to undergraduates of the Sheffield Scientific School in the course in biology.

Professor CHITTENDEN:—

30 *Physiological Chemistry and Physiology.*

Graduate students having sufficient knowledge of analytical and organic chemistry and elementary physiology are received into the Sheffield Biological Laboratory at the beginning of the academic year, where they can pursue a course in physiological chemistry, physiology, and toxicology, extending throughout the entire year. The course necessitates, on an average, four hours of laboratory work per day, and attendance on lectures and recitations three or four times per week. Opportunities are also afforded for the carrying on of original investigations, either in physiological chemistry or experimental toxicology, and to students qualified for such work the laboratory is open during the entire day.

Students desirous of studying any special subject in physiological chemistry and having but a limited amount of time are also received, provided they are qualified by previous work to pursue the study advantageously.

## VII. PURE AND APPLIED MATHEMATICS

### Professor NEWTON :—

- 1 *Analytical Statics.*  
The dynamics of a Particle and of a System of Particles.
- 2 *Higher Geometry.*
- \*3 *Integral Calculus and Mechanics.* 3 hrs. both terms.  
Mean values and probability ; differential equations ; analytical statics and dynamics.
- \*4 *Shooting Stars and Meteors.* 1 hr. both terms.  
The mathematical theories of these bodies, and the treatment of the observations of them.

### Professor CLARK :—

- 5 *Determinants*, with applications.
- 6 *Theory of Curves and Surfaces.*
- 7 *Definite Integrals ; Differential Equations.*
- 8 *Kinematics of a Rigid Body.*

### Professor GIBBS :—

- \*9 *Vector Analysis.* 2 hrs. 1st term.  
Elementary course, in which the simpler problems of geometry, kinematics, and mechanics are treated by vector methods. The matter taught is not entirely unlike that usually given in courses in Quaternions, but the method followed is in some respects nearer to Grassmann's than to Hamilton's.
- \*10 *Vector Analysis.* 2 hrs. 2d term.  
Advanced course, including differentiation with respect to position in space, the theory of the potential and allied functions, and that of linear vector functions. This course is especially designed for an introduction to the study of mathematical physics, and is open only to those who have taken the preceding.

\*11 *Elliptic and Parabolic Motion with Computation of Orbits.*

2 hrs. both terms.

The analytical developments will be made in the vector form.

12 *Electro-Magnetic Theory of Light.* 2 hrs. both terms.

This course will commence with the general theory of harmonic motion and its representation by complex scalar and vector quantities. The laws of electrodynamics are then applied to the phenomena of the propagation of light in isotropic and aeolotropic media, and its reflection at a surface between two such media, with the dispersion of colors. This course is supplementary to one on Electricity and Magnetism (based on Maxwell's Treatise) given in the year '91-'92, which will probably not be repeated until the year '93-'94.

13 *Theoretical Thermodynamics.* 2 hrs. both terms.

This course consists of two distinct parts. The first relates entirely to the sensible properties of matter, being a development of the consequences of the two fundamental laws of thermodynamics, as affording a general theory of physical and chemical equilibrium, and as giving shape to the investigation of the sensible properties of matter. The second part is essentially an application of the theory of probabilities to molecular mechanics, in which the notions of temperature and entropy, and the second law of thermodynamics are deduced from *a priori* considerations.

Professor C. B. RICHARDS:—

*MECHANICAL ENGINEERING.*

This course, arranged for candidates for the degree of Mechanical (or Dynamical) Engineer, is also open to special Graduate Students, who will be allowed in certain cases to take selected parts. The leading topics are:

14 *Applied Mechanics.*

Including graphical methods in applied kinematics, and in the investigation of mechanisms working with friction; graphical determinations of the accelerations of the moving parts of machines; the strength of materials as affecting the proportions of machine elements; the applications of the principles of hydraulics to the construction and working of turbines and pumps.

15 *Thermo-Dynamics.*

Applications to the compound steam-engine, air compressors and compressed air motors, engines worked by volatile vapors, refrigerating machines, the warming and ventilation of buildings.

16 *Machine Design.*

In this course the student is engaged in practical exercises under the guidance of the professor in charge, investigating machinery, and designing and making working-drawings, specifications, and estimates for machines and manufacturing plant. In addition to the study of machines in general, either of the following subjects will at the option of the student receive particular attention: (a) Marine engineering; (b) Railway machinery; (c) Pumping machinery and plant; (d) Machinery and plant for manufacturing. The student is required to make complete drawings, from new designs, of at least one important piece of machinery under one of these subjects. A compound marine engine and boilers, a locomotive, a turbine, driving centrifugal pumps, a blowing-engine for an iron furnace, are examples.

Candidates for the degree of Mechanical Engineer are required to take also a course in Mathematics, to sustain a final examination, and to present a satisfactory thesis on a subject approved by the professor in charge of the course.

A course in applied electricity, and, when the facilities of the physical laboratory permit, a course of laboratory work under the superintendence of the professor in charge; also, lectures on Industrial Legislation and Finance, and lectures on the higher Mathematics, are open to all students in this course.

Professor PHILLIPS :—

17 *Map Projection and Curve Tracing.* 1 hr. both terms.

Discussion and application of the principles of the Perspective, Orthomorphic, and Equivalent Projections of the Sphere. Method of tracing curves by the intersection of mathematical surfaces.

\*18 *Analytical Geometry.* 2 hrs. both terms.

An extension of the course in the plane and solid Analytical Geometry of Sophomore year, including the use of determinants and trilinear coordinates; methods of tracing algebraic and transcendental curves; study of machines for tracing curves and of models of mathematical surfaces.

Professor DuBois:—

*CIVIL ENGINEERING.*

This course offers instruction for advanced graduate students as well as for those students who may be regular candidates for the degree of Civil Engineer. It embraces the following topics:

19 *Mechanics applied to Engineering.*

Including a course in Hydraulics, with reference to the various problems which arise in connection with water-supply, water-power, or irrigation; the efflux of water, flow through orifices and mouthpieces and over weirs, simple and submerged; questions of overflow and land damage; the effect of friction, contraction, enlargement, bends, valves, etc.; measurements of the discharge of pipes, rivers, and streams; the theory and design of water-motors; a course in Thermo-dynamics and its practical application to hot-air, gas, and steam engines.

20 *Surveys and Geodesy.*

Including methods of observation, base measurements, triangulation field work; theory of least squares, adjustment of observations, and computation of geodetic latitudes, longitudes, and azimuths.

21 *Construction and Design.*

Including the strength and properties of materials, construction and design of bridges, roofs, foundations, retaining walls, dams, and embankments, masonry, arches, sewerage and drainage, improvement of rivers and harbors, specifications and contracts, and the preparation of designs and working-drawings.

Candidates for the degree of Civil Engineer are required to take, in addition, a selected course in Mathematics, Practical Astronomy, and when the facilities in the physical laboratory permit, a course of laboratory work, under the superintendence of the professors in charge. They are also required to sustain a final examination, and to present a satisfactory thesis accompanied by appropriate designs, upon a subject approved by the professor in charge of the course.

To special students, not candidates for the degree of Civil Engineer, a selection of special topics is allowed. The lectures of the Department upon Railroad Administration, Industrial Legislation, and Finance, and upon the higher Mathematics, are open to all the students in this course.

22 *Practical Astronomy.*

Instruction, especially adapted to candidates for the degree of Civil Engineer, is given in Practical Astronomy applied to Geodesy, using as guides the treatises of Loomis and Doolittle. The practical instruction embraces the use: (1) of the Theodolite or Surveyor's Transit for determining time, latitude, and azimuth; (2) of the Sextant and Engineer's Transit with solar attachment.

The time devoted to the subject will vary with the taste and purpose of each student and the time at his disposal. But for the degree of Civil Engineer, a good familiarity with the instruments named in 19 and 20, as well as with the corresponding computations and practical problems, is required.

Assistant Professor BEEBE :—

\*23 *Surveying.* 2 hrs. both terms.

*Field Work* : 1st term : Land surveying ; use of chain, compass and surveyor's transit ; construction of verniers and determination of instrumental errors. 2d term : Leveling and Topography ; use of surveyor's level and plane table ; determination of grade lines, contour, cut and fill.

*Office Work* : during the winter ; platting surveys from field notes ; map drawing, plane and topographical ; shading, lettering, and enlargement of maps ; calculations of areas, use of traverse tables.

*Recitations* during the year from Gillespie's or Johnson's Surveying.

\*24 *Practical Astronomy.* 2 hrs. 1st half-year.

Observatory work with astronomical transit and chronograph for determination of sidereal and standard time ; and with sextant and theodolite for determination of latitude and azimuth. Numerical computations for reduction of observations. Recitations from Loomis's Practical Astronomy.

\*25 *Geodesy.* 2 hrs. 2d half-year.

Measurements and computations for a secondary triangulation from a base line of the U. S. Coast Survey ; reductions to center ; distribution of errors ; measurement of a base of verification.

Open only to those who have taken course 23, or its equivalent.